

Evaluation of the Inflation Forecasting Process of the Reserve Bank of India: A Text Analysis Approach

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Abstract

This study is an attempt to evaluate and interpret the monetary policy statements (MPS) of the Reserve Bank of India (RBI) for the five year period since it started conducting monetary policy meetings every alternate month. An important contribution of this paper is the evaluation of the inflation forecasting path of the RBI using information from the statements. Both qualitative and quantitative methodology has been adopted to study and evaluate the MPS. It helps in understanding processes followed and information considered while making inflation forecasts. The results clearly indicate that though the RBI examined the high frequency economic indicators in their process of assessment and inflation forecasting, their inflation forecasts have been below the mark. Similarly, the monetary policy committee (MPC) could not predict the sharp disinflation following demonetization on 8th November, 2016 resulting in higher real interest rate regime. This shows that the monetary policy governance under the new monetary policy framework of the RBI needs to be revisited to align it with the economic reality of India.

Keywords Text Mining, Qualitative Text Analysis, Monetary Policy, Inflation Forecasting, Indian Economy, Demonetization

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1 Introduction

Policy statements by central banks are a rich, largely untapped and unstructured source of information. In what the authors believe is first such attempt in India, this paper evaluates and interprets information culled from monetary policy statements, which record the pronouncement made by the monetary policy committee (MPC) of the RBI in their meetings held once every two months. The paper focuses on how the RBI has been perceiving the inflation trajectory in India and to what extent they have been correct.

Since these statements are in the form of running text, a methodology has to be developed in order to analyze them. An established method for evaluating policy decisions uses quantitative scales derived from sentiment analysis of policy statements. Such index values would reflect the MPC's inflation outlook for the economy. The quantitative index will be complemented with a qualitative evaluation of the textual statements to find out the information that the MPC examined in making their assessment.

Generally macroeconomic analysis invariably includes factors such as the GDP growth trend, fiscal deficit, inflation rate, balance of payments, unemployment level etc. All of these are quantitative measures and their evaluation and forecasting is based on quantitative models. However, policy makers and regulators communicate their perspective about the economic outlook and policy decisions in the form of text. These texts are a rich source of information. The monetary policy statements issued by the RBI at the end of every monetary policy meeting conveys perceptions about the economic outlook through these statements. The market in turn uses these statements to understand the central bank's economic outlook and to assess the future interest rate trajectory that may be followed.

The empirical contribution of this study lies in showing that evaluation of the RBI's policy statements can provide unique insights about monetary policy decision making process. It helps in understanding processes followed and information considered while making inflation forecasts. The researchers have been able to point out that the MPC members did not see demonetization as a major disruption as far as inflation was concerned and were thus taken aback when the inflation rate fell substantially in the subsequent period. This failure prevented proactive action, *e.g.*, reducing repo rate¹ to boost the sagging investment in the economy.

This paper is further structured into sections covering a review of literature describing earlier attempts to evaluate monetary policy statements in order to make macroeconomic forecasts, followed by section 3 namely, 'Data and Methodology' were in the method of quantitative and qualitative analysis has been described and developed. Section 4 named 'Results' analyze and discuss

¹policy rate at which the RBI lends over-night to banks, financial institutions and primary dealers; abbreviation for repurchase rate

results. In the end, this paper concludes with some highlight discussions and conclusion.

2 Literature Review

This section will discuss literature related to evaluation and forecasting of monetary policy statements by various researchers and will conclude with reasons for believing that content analysis of monetary policy statements of the Reserve Bank of India will provide unique insights regarding inflation forecasting in India.

“Summary of commentary on current economic conditions by Federal Reserve District” also known as *Beige Book* is published individually by all the twelve Federal Reserve Banks in the USA eight times a year. Each central bank collects information on current economic conditions in respective districts through reports from Bank and Branch directors and interviews with key business contacts, economists and market experts. These reports are historically available in the USA and contain very rich qualitative data. This has been analyzed by Balke and Petersen (2002), Armesto et al. (2009), Balke et al. (2017), Saltzman and Yung (2018) and Tsukioka and Yamasaki (2018).

Using discourse analysis Balke and Petersen (2002) found that Beige book was a rich source of unique information related to the USA’s economic outlook which was not captured elsewhere.

Similarly, Armesto et al. (2009) used textual analysis to convert qualitative data of Beige Book into sentiments namely, optimism and pessimism. Their analysis also concluded that qualitative information in the Books had predictive power. But, one drawback of the paper was that they could not place context along with the sentiments.

Balke et al. (2017) again concluded that Beige Book contained distinctive information about contemporary economic conditions which were not present in other quantitative indicators. But they also found out that this data advantage was only for three weeks from the release date, *i.e.*, after a period of time this unique information about economic activity were accounted for in other quantitative indicators.

Saltzman and Yung (2018) on the other hand using machine learning techniques had extracted uncertainty measures from the Beige Books between 1970 and 2018. They predicted that business and economic related uncertainty is associated with future weakness in output and higher unemployment.

Tsukioka and Yamasaki (2018) again using text mining techniques had predicted that Beige Book positively related to changes in the Federal fund rates target. They also found that the tone of the Beige Book negatively related to the returns in bond market on Federal Open Market Committee (FOMC) announcement days. They concluded that Beige Book could predict the up-

coming monetary policy and this anticipation influenced the returns on FOMC announcement days.

Similar to Beige Book, minutes of the discussion among all nineteen members of the FOMC also contain valuable qualitative information. These information are from varied sources, like staff's quantitative forecasts as well as the periodic forecasts of the FOMC. These have been studied by many researchers like, Chappell Jr et al. (1997), Boukus and Rosenberg (2006), Apel and Grimaldi (2014), Sheng (2015), Stekler and Symington (2016) and Hansen et al. (2017). All of them have found some predictive power in qualitative information of FOMC minutes. For example, Sheng (2015) concluded that dynamic discussion among FOMC members provided additional insights regarding how economic information was interpreted. Similarly, Stekler and Symington (2016) used qualitative content analysis and text analytic to evaluate the FOMC minutes. They found that FOMC members during the period leading to the financial crisis of 2008 had recognized the associated risks but failed to predict the ensuing financial crisis.

Similarly, Rosa and Verga (2007), Bulíř et al. (2013), Apel and Grimaldi (2012) and Gertler and Horvath (2018) have studied monetary policy statements of European Central Bank (ECB). Kawamura et al. (2019) and Du (2018) evaluated contents of Bank of Japan's (BoJ) statements. Masawi et al. (2018) have done content analysis on monetary policy statements of Bank of Canada and Reserve Bank of Australia.

But, there is no research paper, which has analyzed the content of the RBI policy statements. The justification of using monetary policy statements as data comes from the fact that these statements contain many nuanced insights and have broader perspective in its assessment of risk and uncertainty that an economy faces. These combination of nuance, timeliness, broad purview and attention to risk makes these monetary policy statements a valuable source of insights. These are rich source of data which may allow the researchers to peep into the assessment of Indian and global economic development by the monetary policy committee (MPC). This research paper will attempt to extract useful insights from the monetary policy statements of the RBI.

3 Data and Methodology

3.1 The RBI Monetary Policy Statements as Data

The Reserve Bank of India's monetary policy statements record the understanding, assessment and conclusion of the monetary policy committee regarding current and future economic outlook of Indian and global economies. The discussion in the statement contains two sections, one dealing with the assessment of current economic situation and the other with economic outlook. In economic assessment, Indian and global economic assessment including trade,

gross domestic product, industrial production, inflation, financial markets and business-sectoral assessment are generally discussed. The section on economic outlook enumerates quantitative and qualitative economic forecasts along with the associated risk and uncertainty.

In the this paper economic assessment and outlook related to inflation are extracted from the monetary policy statements of the period under study. Since the Financial Year (FY) 2014-15 the RBI started conducting six monetary policy meetings. Before FY 2014-15 meetings used to take place once in a quarter. In this research paper analysis of data has been done for the period from April 2014 to April 2019, *i.e.*, bi-monthly policy statements period.

In this paper three unique methodologies to evaluate the sentiment and predictive information contained in the monetary policy statements have been used. In the first step an index has been developed to capture the RBI's sentiment regarding the future inflation trajectory and it has been compared with actual inflation index. In the second step quantitative text analysis is used to identify the sub-groups of inflation that dominated the RBI monetary policy discussions. Thirdly, qualitative text analysis has been carried out to identify and evaluate risk and uncertainties that the policy statements identified.

3.2 Scaling Inflation Forecast

3.2.1 Scaling Inflation Sentiments from the Statements

An index for each of the thirty-one statements by the RBI Governor from April 2014 to April 2019 was constructed. The index measured the RBI's sentiment regarding future inflationary path. The sentiment was derived from inflation part of *outlook* section of the statement. In each of the statement inflation *outlook* paragraphs generally begin like, "going forward, the inflation outlook is expected to be.....", and then it sums up the policy committee members' opinion about inflation outlook in the intermediate future. These paragraphs can be taken as a data, which qualitatively predicts future inflation outlook for the Indian economy.

Goldfarb et al. (2005) were the first who used an outlook scale to analyze the forecast error of economists during 1930s Great Depression in the USA. The method was later adopted by Lundquist and Stekler (2012) and Stekler and Symington (2016) to analyze economists' forecast leading to the great depression and to evaluate qualitative forecasts of the Federal Open Market Committee (FOMC) minutes respectively. In this study the same outlook scale has been adopted. The scale values range between +1 to -1, with gradations of 0.25. For instance, statements that perceived strong deflationary trend was given a score of +1, whereas statements that perceived strong inflationary trend was awarded a score of -1. Table 1 contains the criteria for scaling the statements' inflationary sentiment. The outlook has been divided in three broad categories namely, optimistic, neutral and pessimistic.

The outlook scale criteria is based on the list of indicative phrases/words from the policy statements which encapsulate the inflation outlook sentiment of the MPC in their respective meetings. For instance, a score of +1 is given for those statements where words like “sharp decrease” or “sharp deceleration” are used in the context of inflation outlook, while score of +1/2 is associated with words like “modest”, “benign”, or “temper inflation”. Table 1 also contains these list of lexical words used to score all the monetary policy statements.

Table 1: Criteria for scaling the outlook of the policy statements qualitative forecasts

Outlook	Assessment	Score	Recurring words from the minutes used fore scoring
Optimistic	Sharp disinflation	+1	Substantial decrease, sharp decrease, sharp deceleration
	Normal disinflation	+3/4	Contain, improve, dip, steady decrease, soft, weak, downward, reduction, fall, decline
	Modest disinflation	+1/2	Transitory, modest, benign, temper inflation
	Slow disinflation	+1/4	Slow, soften, downside muted
Neutral	Unclear	0	Unclear, mixed, volatile, unchanged, uncertain
Pessimistic	Slow reflation	-1/4	Subdue, upside muted
	Modest reflation	-1/2	Modest, persist, elevate, moderate, edge-up
	Reflation	-3/4	Rebound, raise, upward, upturn, spike, firm, rose, increase
	Strong reflation	-1	Stubborn, strong, substantial increase, sharp increase, sharp spike

Source: Constructed by the researchers

3.2.2 Scaling Actual Inflation

Actual inflation must also be indexed in the same manner as sentiment index so that they can be compared. Inflation data used for the concerned month is the consumer price index (CPI) from the *Ministry of Statistics and Programme Implementation of India (MOSPI)*. The CPI inflation data for the related months are shown in Table 2. This series has been calibrated using a scale which connects the MPC outlook score with actual inflation. The calibrating scale is shown in Table 3.

Table 2: Real Time Consumer Price Index (CPI) inflation Y-O-Y (in %)

Month	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
April	8.48	4.86	5.47	2.99	4.58	2.92
June	6.67	5.40	5.77	1.54	4.90	NA
August	7.03	3.74	5.04	3.36	3.70	NA
October	4.62	5.00	4.20	3.58	3.38	NA
December	4.28	5.61	3.41	5.21	2.11	NA
February	5.37	5.26	3.65	4.44	2.57	NA

Source: Ministry of Statistics and Programme Implementation of India (MOSPI)

Table 3: Calibration scale linking outlook scores with actual inflation numbers

As- sess- ment	Sharp disin- flation	Nor- mal disin- flation	Mod- est disin- flation	Slow disin- flation	Neu- tral	Slow rein- flation	Mod- est rein- flation	Rein- flation	Strong rein- flation
score	+1	+3/4	+1/2	+1/4	0	-1/4	-1/2	-3/4	-1
change in in- flation (% Y- O-Y)	-1.5 to -2.0	-1.0 to -1.5	-0.5 to -1.0	0 to - 0.5	0	0 to 0.5	0.5 to 1.0	1.0 to 1.5	1.5 to 2.0

Source: Constructed by the researchers

3.2.3 Text Analytic to Identify Inflation Sub-groups

Text analytic is a systematic method to describe and interpret the content and structure of messages in the text body. In this research paper both qualitative and quantitative methods of content analysis have been used.

Quantitative text analysis uses software based natural language processing and machine learning techniques to investigate pattern and features in text data. In other words, this process involves knowledge discovery from unstructured textual database (Feldman and Dagan, 1995).

While, reading inflation related content of the RBI monetary policy statements it was noticed that the discussion was dominated by the issues related to three sub-categories of inflation *viz.*, food, fuel and core. To measure the MPC members' concern with and interest in these topics, the researchers have used the text mining package called '*tm*' developed by Meyer et al. (2008) in the popular open source statistical software *R*. '*tm*' has been used to perform data cleaning and text analysis. The index was constructed from specific inflation related words/phrases from the monetary policy statements between April 2014 and April 2019.

Given the mandate of the RBI as an inflation targeting central bank, the frequency of food, fuel and core inflation related words in each of the statements was recorded. List of words related to each of the inflation sub-group is shown in Table 4. The frequency of the inflation categories depicted a trend over time which has been juxtaposed with the forecasted trend emanating from the MPC statements.

Table 4: Word list belonging to each inflation sub-group

Inflation sub-group	list of identified words
Food	Food, acreage, agriculture, alcohol, animal, beverage, buffer, cereal, commodity, fat, fertilizer, fish, fruit, kharif, rabi, mandi, meat, milk, msp, nino, oilseed, onion, procure, protein, pulse, rain, rainfall, season, spice, sugar, tomato, unseasonal, vegetable
Fuel	Fuel, crude, oil, geopolitical, petrol, diesel, electricity, fire, wood, kerosene, cook, gas, chip, dung, coal
Core	Core, education, health, transport, house, rent, medical, personal, recreation, amusement, water, tuition, fee, taxi, auto, fare, tobacco, intoxication, gold, cloth, footwear

Source: constructed by the researchers

3.2.4 Qualitative Textual Analysis

Qualitative text analysis often called qualitative content analysis (QCA) is one of the most useful method for analyzing text content (Guest et al., 2011; Kuckartz, 2014; Schreier, 2012). In this paper both quantitative index and qualitative text analysis have been used to analyze monetary policy meeting deliberations and decisions. QCA has been conducted in two phases. In first phase major risk and uncertainties related to inflation outlook has been identified. And in the second phase thematic coding and summarization of these risk and uncertainties have been carried out. The application of conventional text analysis enabled the researchers to go for in-depth analysis of these statements in order to draw further understanding of the policy statements.

While going through the text of the statements the researchers were motivated to seek answers to the following questions: *what did the committee members know about the economy? when did they become aware about changing dynamics of inflation? and why and when did they decide to revise their outlook?*

4 Results

4.1 *Mapping Inflation Sentiment with Actual Inflation*

Table 5 and Figure 1 show index of inflation sentiment that has been developed from a qualitative analysis of monetary policy statements of the RBI and actual inflation numbers. As can be seen from the Figure 1 in 15 of the 31 months under consideration the direction of inflation predicted by the RBI was the opposite of the actual inflation. In only 5 months in this period the predicted and actual inflation had been at par.

Sign test was conducted to statistically see if forecasted inflation could predict actual inflation. The results are shown in Table 6. The test was conducted on the sign of differences between actual and predicted inflation index. As can be seen from the table binomial-test result is insignificant. It indicates that sentiment index and actual inflation index data distribution are independent of each other, *i.e.*, forecasted inflation could not predict actual inflation over the period of analysis.

The period between June 2016 to February 2018 was particularly interesting as, the statements during that period had generally predicted increase in inflation. On contrary the inflation in these 10 months had actually decreased. One of the reasons for this might have been that the monetary policy makers failed to appreciate the underlying inflation dynamics in the wake of multiple fiscal policy shocks. It must be noted that this was also the period when the differences relating to the policy interest rate between the RBI and the central government became public. During this period the government took major fiscal policy decisions like the implementation of the 7th Pay Commission report (29th June 2016), demonetization of high denomination currency notes (8th November 2016) and implementation of the Goods and Services Tax (1st July 2017).

4.2 *What the Policy Makers knew and when*

What did the RBI know about the unfolding future inflationary trend in India? From the Table 5, it can be seen that, there were several policy meetings in which inflation outlook sentiment saw radical changes. First of such changes could be seen in December 2014 when the monetary policy sentiment turned negative whereas, inflation for the month actually came down. Similarly, during the period between August - December, 2016 the RBI's sentiment again turned inflationary, though inflation in those months came down sharply. In fact, it must be noted that out of 16 meetings of the MPC (first meeting being in October 2016) it had shown inflationary sentiment in 12, though, inflation rate actually rose in only 7 months out of them. In other words, forecasting by the MPC was biased towards increase rather than decrease in inflation.

Another interesting period was between August - December, 2018. During

Table 5: Inflation Sentiment versus Actual Inflation

Time	Sentiment Index	Actual Index
Apr'14	0.25	0.5
Jun'2014	0.5	1
Aug'2014	0.75	-0.25
Oct'2014	0.75	1
Dec'2014	-0.25	0.25
Feb'2015	0.5	-0.75
Apr'2015	0	0.25
Jun'2015	0.25	-0.5
Aug'2015	0.25	1
Oct'2015	-0.25	-0.75
Dec'2015	-0.25	-0.5
Feb'2016	0.25	0.25
Apr'2016	0.25	-0.25
Jun'2016	0	-0.25
Aug'2016	-0.25	0.5
Oct'2016	-0.25	0.5
Dec'2016	-0.5	0.5
Feb'2017	-0.25	-0.25
Apr'2017	-0.5	0.5
Jun'2017	0	0.75
Aug'2017	-0.75	-1
Oct'2017	-0.25	-0.25
Dec'2017	-0.5	-1
Feb'2018	-0.5	0.75
Apr'2018	0.5	-0.25
Jun'2018	-0.25	-0.25
Aug'2018	0.25	0.75
Oct'2018	-0.25	0.25
Dec'2018	0.25	0.75
Feb'2019	-0.5	-0.25
Feb'2019	-0.25	-0.25

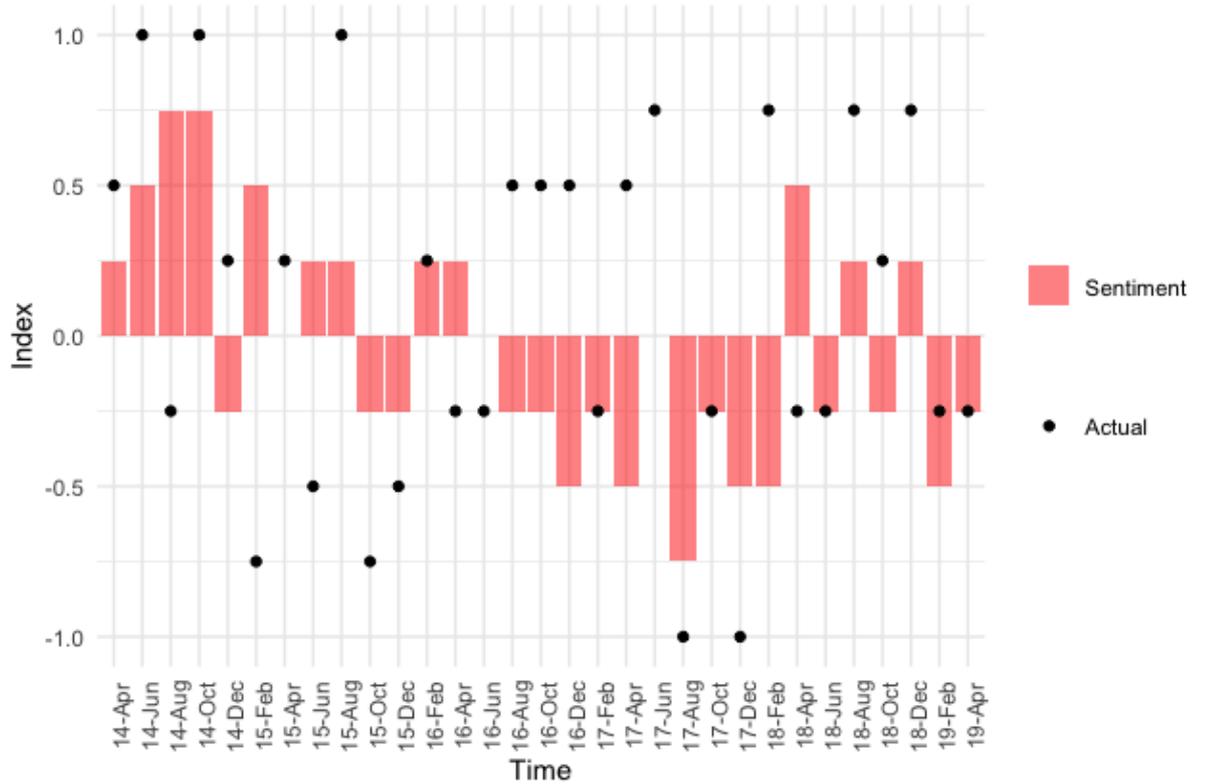
Source: Compiled by researchers from the Tables 1, 2 and 3

Table 6: Sign Test Result

No. of Positive changes	No. of Negative Changes	Total Count	p value
15	11	26	0.55

Note: Positive changes have been counted by taking difference of 'actual index' and 'sentiment index' from Table 5. t statistic is 0.84 and t-critical is 1.71. So we accept the null hypothesis that there is no relationship between predicted and actual inflation index.

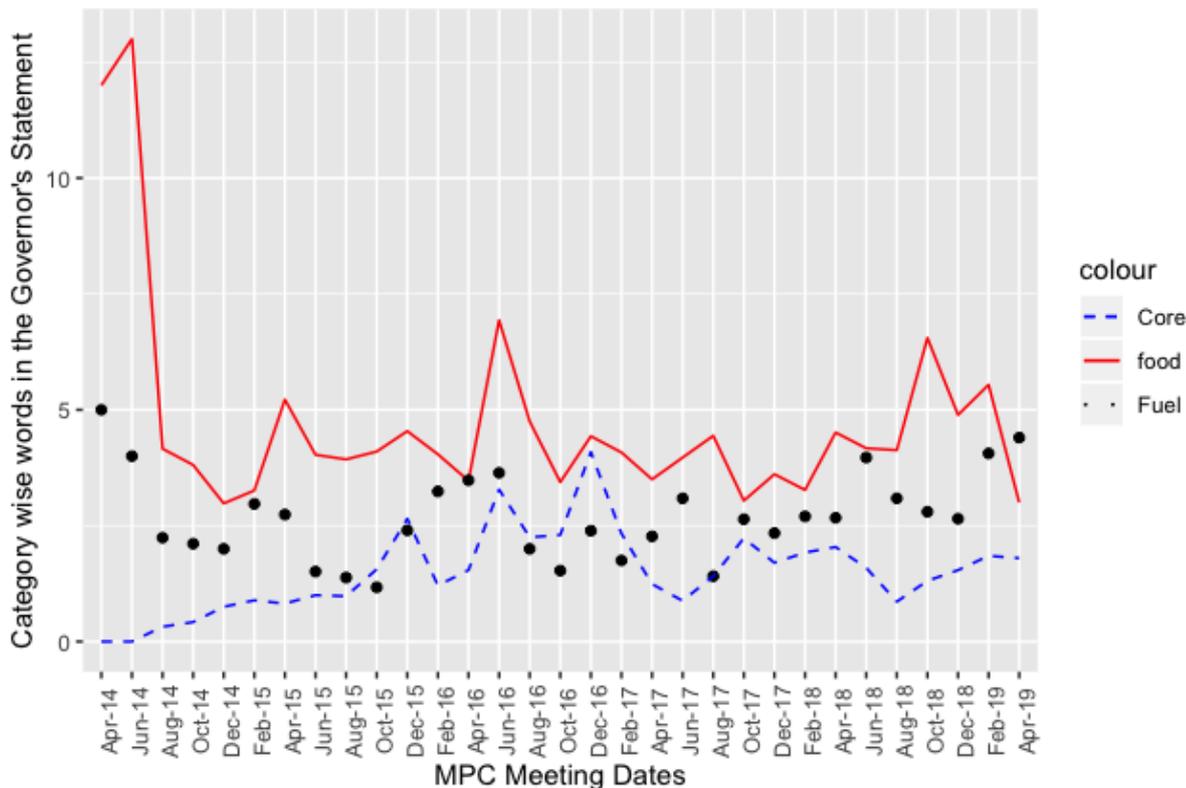
Figure 1: Inflation Sentiment versus Actual Inflation



this period the MPC failed to predict the sharp deceleration in inflation. In its August 2018 meeting the MPC predicted inflation at 4.8% during the second half of the FY 2018-19, though it decelerated to a low of 1.97% in January 2019. One important implication of this misprediction was a very high real interest rate (4.03% in January 2019) for the economy at a time when economic growth was already slowing down.

While the MPC did not predict the sharp deceleration in inflation during the third quarter of FY 2018-19, it quickly and correctly observed the underlying deceleratory trend in food inflation in August 2018 policy meeting. But even then it could not predict the deflation in food prices observed during the quarter. In fact, it had raised concerns regarding an inflationary impact of the central government’s decision to fix the minimum support price for food grains at 150% of the cost price (10/05/2018).

Figure 2: Category wise words in the Governor's Statement



4.3 Major Inputs to the Inflation Forecasts

While the index in the Table 5 unveiled changes in the inflation outlook of MPC members over time, it did not specify information that had pronounced impact on their judgement though obviously, latest economic and inflationary facts were presented and discussed at each meeting. To determine dominance of various inflation sub-groups in each of the policy statements and their impact on policy outlook changes text mining was used.

The results obtained using *R-statistical software* are presented in the Figure 2. Inflation index has been divided into three sub-groups namely, food, fuel and core. Food and fuel inflation are supply driven and majorly dependent upon Monsoon and international crude oil prices respectively. Whereas, core inflation is considered demand driven and it also indicates pricing power of manufacturing and service providers. In the figure, frequency of words related to each inflation category are depicted. Food inflation has consistently dominated the other categories of inflation. But, its dominance has decreased over time. Fuel inflation which is related to international crude oil price as well

as international geo-political developments has been the second most discussed inflation category. As crude price stumbled in 2016 its importance in discussion also diminished, while when the international crude price started increasing in 2017, fuel inflation related discussions registered an increase.

Discussions on core inflation has generally lagged behind food and fuel except during Aug-2016 to Feb-2017 when the RBI was majorly concerned about the impact of the 7th pay commission on inflation. Core inflation had been persistently above 5% during the period under study. Still, it was not a major concern (as seen by mentions in the policy statement) for the RBI because there was less volatility than for the other categories. So, from the space given to different inflation categories it is clear that the RBI remained obsessed with food and fuel inflation under the presumption that the major volatility in headline inflation (CPI) would come from the supply side rather than the demand side of the economy.

4.4 Risks and Uncertainties to Inflation Outlook: Qualitative Text Analysis

The index developed in this paper represents estimates of the MPC's outlook. In monetary policy statements there are sections which deal with risk and uncertainties that the committee identifies with the inflation outlook. These provide a parallel qualitative representation of fan charts used to convey risks to the inflation outlook path. These risk and uncertainties have been analyzed using qualitative content analysis (QCA). In the first phase major risks and uncertainties related to projected inflation trajectory between April 2014 to April 2019 have been identified. The result of which are summarized in table 7. In the next phase themes of the identified risks and uncertainties have been coded. The result is shown in table 8.

From table 7 it can be seen that throughout FY 2014-15 and 2015-16 the MPC was concerned with monsoon rainfall deficit and its impact on the food-grain production. The concern of the MPC regarding rainfall deficit was justified as 45.86% of the CPI constituted of food items. The RBI remained hawkish about the monetary policy and kept the repo rate unchanged at 8% throughout FY 2014-15.

In FY 2014-15 the central bank was also cautious about the Federal Reserve System's (The USA central banking system) possible normalization of monetary policy and its spill-over impact on the Indian Economy (06/02/2015, 08/04/2015). Despite inflation coming down from 8.6% in January 2014 to 5.6% in December 2015 the household's inflation expectation was still in double digits (12/01/2015).

Looking at the Governor's statements for the FY 2016-17, it can be observed that the RBI was taken aback by the unfolding inflation trajectory (04/05/2016, 06/07/2016, 08/09/2016, 12/07/2016, 02/08/2017). The volatility in food infla-

tion was the main reason for this unexpected upward trend in inflation. During this period It is also interesting to look at the assessment of the RBI with respect to the impact of demonetization (announced on 8th of November, 2016) on inflation. Monetary policy committee (whose inaugural meeting was on October 3-4 2016) in its December 2016 meeting concluded that demonetization would have marginal impact on inflation. In reality however, the inflation went down from 4.20% in October 2016 to 3.17% in January 2017, a reduction of 103 bps.

During the financial year the committee also saw the central government's implementation of the 7th pay commission as a major risk and uncertainty for the inflation trajectory, particularly in housing sub-indices (10.00% of CPI). But with the benefit of hindsight we can say that any significant impact of the 7th pay commission on headline inflation was not observed, as CPI kept plummeting continuously since the 7th pay commission's implementation in June 2016 till the end of FY 2016-17. This may be due to the fact that the pay commission was implemented phase wise first for the central government employees and then for state government employees.

Throughout FY 2017-18, the MPC was concerned with the risk of fiscal slippage owing to GST implementation, farm loan waivers, the 7th pay commission implementation and revision in minimum support price (MSP) for *khariif* crops. In this period the state governments also started implementing the 7th pay commission recommendations and the RBI considered it as an uncertainty to the inflation trajectory. The increase in perceived risk was also displayed in the inflation outlook index displayed in the Figure 1.

Reading through the statements of FY 2018-19 shows that the RBI over-estimated the inflationary path and risks associated with it. For example, in its April 05, 2018 statement the MPC had forecasted that the inflation in the second half of FY 2018-19 will be 4.4% whereas, actual inflation came down to the range of 1.97-3.38%/. The MPC saw changes in the central government's public procurement policy as a risk. The central government took a decision to fix the MSP of crops to at least 150% of the cost of production. It also saw oil price disruption due to the USA-Iran stand-off as a major external risk to inflation.

The impact of this misreading of the inflation trajectory during the period can be seen in increase in the repo rate from 6% at the start of the year to 6.5% in August 2018. Inflation reading of January 2019 was only 1.97% whereas repo rate for the month was 6.5%, *i.e.*, real interest rate of as high as 4.53%. This led to a bitter friction between the central government and the RBI culminating in the resignation of the then Governor, Dr. Urjit Patel. The sharp decline in inflation was mainly due to deflationary trend in food and fuel inflation, whereas the core inflation excluding food and fuel was sticky at around 5.5-6%.

With the benefit of hindsight it is always easy to see the risks that an economy faced but for the policy makers who have to make projections about future it is difficult to evaluate the risks that the economy would be facing in future.

However, it appears, in many instances, the MPC was correct in their evaluation of the risks and uncertainties related to inflation projection. But, their success in quantifying these risks and uncertainties comes across as a mixed bag. They had been able to predict the right direction of inflationary path in only 16 out of 31 months under study as displayed in Figure 1.

Table 7: Risks related to the inflation forecasts

Time	Current Risk:Inflation	Uncertainty
04/2014	El nino effects: <i>Food</i>	Setting of minimum support price (MSP) for agricultural commodities and administered prices of fuel: <i>Food and Fuel</i>
06/2014	Sub-normal/delayed monsoon and setting of administered prices: <i>Food & Fuel</i>	
08/2014	Pass-through of administered price increases: <i>Fuel</i>	Monsoon conditions, geo-political concerns: <i>Food & Fuel</i>
10/2014	Full effects of the monsoon's passage <i>Food</i>	
12/2014	Administered price corrections and weaker-than anticipated agricultural production: <i>Food</i>	Possible normalization of monetary policy by the Federal Reserve of the USA: <i>Core</i>
02/2015		Spatial and temporal distribution of the monsoon during 2015: <i>Food</i>
04/2015	Possible intensification of el nino conditions: <i>Food</i>	geo political developments: <i>Food & Fuel</i>
06/2015	Below normal monsoon: <i>Food</i>	Volatility in external environment: <i>Fuel and Core</i>
08/2015	Sustained hardening of core inflation: <i>Core</i>	Full effect of the service tax increase: <i>Core</i>
09/2015		Pass-through of the recent depreciation of the rupee: <i>Fuel</i>
12/2015	El nino induced shortening of winter: <i>Food</i>	
02/2016		Implementation of the 7 th central pay commission (CPC) award: <i>Core</i>
04/2016		Unseasonable rains and low water reservoir level: <i>Food</i>
06/2016	Firming international commodities prices: <i>Food, Fuel & Core</i>	
08/2016	Implementation of 7 th CPC recommendation on allowances: <i>Core</i>	
10/2016	7th CPC award on house rent allowances and the increase in minimum wages: <i>Core</i>	
12/2016		If the usual winter moderation in food prices does not materialize due the demonetization disruption: <i>Core</i>
02/2017	Volatile exchange rate: <i>Core</i>	

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Table 7 – continued from previous page		
Time	Current Risk:Inflation	Uncertainty
04/2017	Implementation of 7 th CPC: <i>Core</i>	Rising probability of El Nino event: <i>Food</i>
06/2017	Fiscal slippages with the announcements of large farm loan waivers: <i>Core</i>	
08/2017	Impact of price revisions withheld ahead of the GST: <i>Core</i>	States implementation of 7 th salary: <i>Core</i>
12/2017	Fiscal slippages due to decrease in GST collection: <i>Core</i>	
02/2018	Fiscal slippage as indicated in the Union Budget: <i>Core</i>	
04/2018	Revised formula for MSP in Union Budget for <i>Kharif crops:Food</i>	
06/2018	Global financial market development: <i>Core</i>	Impact of MSP price revision for <i>kharif</i> crops: <i>Food</i>
08/2018	Decision to fix MSP of Kharif crops at least 150% of the cost of production: <i>Food</i>	Nature and scale of government procurement operations: <i>Core</i>
10/2018	Oil price disruption due to geo-political risk: <i>Fuel</i>	
12/2018		Exact impact of MSP on inflation: <i>Food</i>
02/2019	Volatile vegetable prices: <i>Food</i>	
04/2019		Sustainability of soft fuel inflation: <i>Fuel</i>

Table 8 summaries Table 7 with respect to inflation sub-groups. It can be seen from the table that the RBI generally had identified Monsoon rainfall and government minimum support price policy as major risk and uncertainties to the inflation outlook. More importantly risks related to food inflation was mentioned in 57% of the policy meets. Since Food and fuel are supply induced shocks and they had been mentioned repeatedly in the policy meets as risk factor, it can be summarized that the monetary policy makers were mostly concerned with supply side shocks. When it comes to core inflation, which was mentioned in 46% of the meetings geo-politics, global monetary policy, government 7th pay commission implementation and fiscal slippage were the main risk factors.

Again the qualitative text analysis like quantitative analysis in the earlier section shows that the RBI was much more concerned about supply side shock than the demand side shocks. Which also means that even the RBI through its policy statements seemed to suggest that the CPI index is mainly impacted by food and fuel shocks in India, than monetary policy's repo rate.

Table 8: Risk and uncertainties related to each inflation sub-group and sub-group’s prevalence in the policy making of the RBI

Inflation sub-group	list of risk categories	sub-group’s prevalence* (%)
Food	El Nino effect, minimum support price, Monsoon, disruption in production, vegetable price, global commodity price	57
Fuel	Administered price, geo-politics, exchange rate, global commodity price	30
Core	geo-politics, global commodity price, 7 th pay commission, House rent allowance, Fiscal slippage, global financial market, global monetary policy	46

*% of policy meetings in which the sub-group has appeared divided by total policy meetings under consideration.

Source: Derived from table 7 by the researchers

5 Discussions and Conclusion

This paper demonstrates that analysis of qualitative data could unveil information that is generally overlooked. The corpus of policy statements issued by the RBI Governor after the MPC meetings has been considered for this study. Previously researchers had used text data of minutes of the meetings of other central banks to evaluate the effect of meeting discussion on policy decisions (Schonhardt-Bailey, 2013; Hansen et al., 2017). These statements facilitated an investigation of the forecasting process and provided an understanding of economic variables considered as well as the approach followed in policy formulation.

The analyses of policy statements reveal that the policy makers scrutinized voluminous economic, financial, sectoral data as well as economic indicators to gauge and forecast the macroeconomic outlook. The committee in all its meetings extensively discussed agriculture induced inflation with great emphasis on monsoon and provision of minimum support price for food grains.

With the benefit of hindsight it can be said that while the MPC followed a robust forecasting process it failed to foresee the sharp deflationary trend in food inflation in FY 2018-19. During October 2018 to February 2019 when the food inflation was negative the MPC had predicted inflationary risk in food inflation owing to government MSP revision for *Kharif* crops. Significantly, policy makers failed to recognize the secular deceleration in food-CPI inflation (constituting 46% of CPI) since the demonetization. .

There are several possible explanations for this failure. Since demonetization is a rare, unprecedented event, the MPC members were ill-equipped to understand its impact on inflation. This can be seen clearly from the MPC meeting of December 2016 which had forecasted a merely transitory effect of demonetization on inflation. On the contrary, demonetization had long term impact on several important aspects of the economy, for example, rural wages are depressed even after three years of demonetization. Furthermore, the MPC framework was new, with its inaugural meeting held in October 2016, just a month before demonetization. Added to these is the fact that food deflation is practically unprecedented in India, making it all the more challenging for MPC members to grasp the extent of food deflation stickiness. Similarly, geopolitical environment during 2018-19 was unpredictable owing particularly to the USA-China trade war and the USA-Iran stand-off. Finally, the committee may have fallen short of realizing that the deceleration in inflation during 2018-19 would be so “sharp” and for so long. The paper leaves it to the wisdom of other researchers to ascertain which of these interpretations have merit.

This study also provides insight regarding the forecasting process followed by the MPC. In this paper it has been shown that it is possible to gauge policy sentiment by transforming the policy statements into quantitative indices. The researchers have been able to conclude that the MPC members did not see demonetization as a major disruption as far as inflation was concerned and were taken by surprise when it crashed in the subsequent months. They did not even take proactive measures by reducing repo rate sufficiently since they believed that the dip in inflation was temporary. This might have hurt the economy as the real interest rate at that time was very high. Textual analysis enabled the researchers to find out variables that were accorded more importance in policy deliberations. These were the variables which influenced the inflation outlook of the members.

Finally, the researchers have made some suggestions for further research using the framework of methodology used in this study. If one is interested in finding out the forecasting error, or biasness of one particular committee member, he/she can use this framework to convert qualitative data into quantitative and then can use relevant non-parametric statistical methods to test hypotheses. It would also be interesting to find out whether the policy statements had any predictive relationship with any other financial variable like bond market or equity market.

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